

Claims

We claim:

1. An optical element holding and extraction device comprising:  
an optical element  
an optical element holder comprising a tubular gripping portion and a tubular extraction portion connected at one end to the tubular gripping portion and having a diameter less than the tubular gripping portion, the tubular gripping portion gripping the peripheral edge of the optical element; and  
a retainer slideably carried on the tubular extraction portion.
2. A device according to claim 1, wherein the holder is rotatable within the retainer about a common axis, and rotation of the holder rotates the optical element.
3. A device according to claim 2, wherein  
the retainer comprises an externally threaded sleeve;  
the optical element is substantially round; and  
the axis of rotation is also common with the optical element.
4. A device according to claim 1, further comprising:  
a mounting structure comprising an optical element receiving surface,  
wherein the retainer is removeably engaged with the mounting structure and secures the optical element against the optical element receiving surface.
5. A device according to claim 4, further comprising a seal interposed between the optical element and the optical element receiving surface.
6. A device according to claim 4, wherein the retainer is threadably engaged with the mounting structure.
7. A device according to claim 6, wherein the retainer comprises an externally threaded sleeve.
8. A device according to claim 4, wherein the tubular gripping portion comprises a shoulder that is interposed between the retainer and the optical element.

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9. A device according to claim 1, wherein the optical element is selected from the group consisting of a fully reflective mirror, a partially transparent, partially reflective mirror, and a fully transparent window.

5 10. A device according to claim 1, further comprising a catch disposed on the exterior surface of the tubular extraction portion at an end opposite to the end connected to the gripping portion.

11. A device according to claim 10, wherein the catch is selected from the group consisting of a snap ring and a detent.

10 12. A device according to claim 1, wherein the gripping portion comprises an annular clip in which the optical element is received and a stop provided on the inner surface of the annular clip, said stop holding the optical element in the annular clip.

13. A device according to claim 12, wherein the stop is selected from the group consisting of a snap ring and a detent.

15 14. A device according to claim 1, wherein the mounting structure comprises a flexible tube element comprising a base end, an optical element receiving end, an optical element receiving surface within the flexible tube element proximate to the receiving end, and a flexible section interposed between the base end and the receiving surface.

15. A device according to claim 14, wherein the flexible section comprises a bellows.

20 16. A gas laser, comprising:  
a tube having a first end wall at one end and a second end wall at the other end, wherein the tube defines a cavity for containing a laser gas therein, and the first end wall includes a port;

25 an optical axis extending longitudinally through the tube and passing through the port;

a mounting structure mounted on the first end wall of the tube, the mounting structure comprising an optical element receiving surface and an aperture extending through the receiving surface, wherein the aperture is disposed transverse to the

optical axis and is aligned with the port and the optical axis so that the optical axis passes through the aperture;

an optical element;

an optical element holder comprising a tubular gripping portion and a tubular extraction portion connected at one end to the tubular gripping portion and having a diameter less than the tubular gripping portion, the tubular gripping portion gripping the peripheral edge of the optical element;

a retainer slideably and rotateably carried on the tubular extraction portion, the retainer being removeably engaged with the mounting structure and securing the optical element against the optical element receiving surface to form a gas tight seal therebetween; wherein

the optical element is disposed transverse to the optical axis and the optical axis impinges on the optical element.

17. A device according to claim 16, wherein the holder is rotateable within the retainer about a common axis, and rotation of the holder rotates the optical element.

18. A gas laser according to claim 16, wherein the retainer may be loosened without completely disengaging from the mounting structure, and wherein when the retainer is loosened the holder is rotateable within the retainer about a common axis, and rotation of the holder rotates the optical element.

19. A gas laser according to claim 18, wherein the holder may be rotated without breaking the seal between the optical element and the optical element receiving surface.

20. A gas laser according to claim 18, wherein the retainer comprises an externally threaded sleeve; the optical element is substantially round; and the axis of rotation is also common with the optical element.

21. A gas laser according to claim 16, further comprising an O-ring interposed between the optical element and the optical element receiving surface.

22. A gas laser according to claim 16, wherein the retainer is threadably engaged with the mounting structure.

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23. ~~A gas laser according to claim 22, wherein the retainer comprises an externally threaded sleeve.~~

24. A gas laser according to claim 16, wherein the tubular gripping portion comprises a shoulder that is interposed between the retainer and the optical element.

5 25. A gas laser according to claim 16, wherein the optical element is selected from the group consisting of a fully reflective mirror, a partially transparent, partially reflective mirror, and a fully transparent window.

26. A gas laser according to claim 16, further comprising a catch disposed on the exterior surface of the tubular extraction portion at an end opposite to the end connected to the gripping portion.

27. A gas laser according to claim 26, wherein the catch is selected from the group consisting of a snap ring and a detent.

28. A gas laser according to claim 16, wherein the gripping portion comprises an annular clip in which the optical element is received and a stop provided on the inner surface of the annular clip, said stop holding the optical element in the annular clip.

29. A gas laser according to claim 28, wherein the stop is selected from the group consisting of a snap ring and a detent.

30. ~~A gas laser according to claim 16, wherein the mounting structure comprises a flexible tube element comprising a base end, an optical element receiving end, an optical element receiving surface within the flexible tube element proximate to the receiving end, and a flexible section interposed between the base end and the receiving surface.~~

31. A gas laser according to claim 30, wherein the flexible section comprises a bellows.

25 32. A gas laser according to claim 30, wherein the base end is hermetically sealed to the first end wall around the port so that the optical axis of the laser passes through the flexible tube element.

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33. A gas laser according to claim 18, wherein the optical axis passes through the optical element at a point that is eccentric to the rotational axis of the optical element.

34. A gas laser according to claim 19, wherein the optical axis passes through the optical element at a point that is eccentric to the rotational axis of the optical element.

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